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A Century of American Weeds.

THEIR ROOT SYSTEMS TABULATED.

BY BYRON D. HALSTED.

Weeds, it is claimed, do their greatest damage to crops by robbing the soil of those food elements that would otherwise go to the building up of the legitimate plants. If this be true, and the conclusion is a reasonable one, it follows that the root system of these "sappers and miners" is of special importance.

During the past summer, in the making of a collection of a hundred worst weeds as an economic herbarium to be distributed to the agricultural colleges, experiment stations and other institutions, particular attention has been given to the subterranean portion of each species, and with very few exceptions the root system, entire as possible, is shown with each specimen. In this respect the collection is unique, thanks to the untiring patience and deftness of Mr. J. A. Kelsey, my assistant, who has performed in large part the painstaking labor of collecting, pressing, and mounting the specimens.

A prolonged study of the century of specimens, or more accurately the fifty or more specimens of each of the hundred species, has led to a classification of the root systems as presented in the accompanying table. The first division of the plant is upon their duration, namely, into those with perennial, those with biennial, and those with annual roots. Next, under each of these heads the root systems are again divided into those with tap-root prominent, with roots in a cluster (fascicled), and those with the two systems more or less evidently combined. Under each of these heads the roots are again classified as to their size—figure 1 standing for the largest, 3 for medium, and 5 for the smallest, while 2 and 4 are midway from the middle size in their respective directions in the scale.

TABULATION OF ROOT SYSTEM OF WEEDS.

	Tap-Roots.	Fascicled.	Mixed.	Totals.
Perennials	1=10	1	0	11
	2= 5	4	4	13
	3= 3	4	1	8
	4= 0	2	0	2
	5= 0	0	0	0
Total,	18	11	5	34
Biennials	1=9	0	0	9
	2=1	2	0	3
	3=1	1	1	3
	4=1	0	0	1
	5=0	1	0	1
Total,	12	4	1	17
Annuals	1= 1	0	0	1
	2=16	0	3	19
	3= 9	6	2	17
	4= 2	4	2	8
	5= 0	4	0	4
Total,	28	14	7	49
			Grand Total,	100

Of those with the roots of the largest size, that is class 1, there are of perennials eleven, biennials nine, and annuals one; and all of these are with tap-roots except one, and that is a perennial with a large mass of roots extending in all directions. The plant in question is none other than the live-for-ever (*Sedum Telephium*, L.,), which is able to propagate by means of its roots when broken into small pieces by implements for land cultivation. The ten perennial weeds with conspicuous tap-roots are: *Saponaria officinalis* (bouncing bet), *Hypericum perforatum*, L. (St. John's wort), *Arctium Lappa*, L. (burdock), *Cnicus arvensis* (L.), Hoffm. (Canada thistle), *Taraxacum officinale*, Weber (dandelion), *Apocynum cannabinum*, L. (dogbane), *Convolvulus arvensis*, L. (bindweed), *Convolvolus sepium*, L. (bracted bindweed), *Ipomœa pandurata* (L.), Meyer, (man-of-the-earth), and *Rumex crispus*, L., (dock). This is a big-rooted set of perennials named in the order that they appear in Gray's Manual. The wild potato-vine (*I. pandurata*) sometimes has a root that attains the size, and occasionally the form, of a boy's body, and weighs thirty-five pounds. Belonging to the same family are the two species of *Convolvulus*, and all are related to the sweet potato and yam, which are grown for their large roots. All three of these weeds are eradicated with great difficulty because of the perennial nature of the large, deeply-buried roots. The *Apocynum* is perhaps the least abundant of the weeds named above, but is remarkable for the size and persistence of its roots when once established in cultivated ground. The dandelion is familiar to all, and its tap-root, enormous for the size of the plant, rivals that of the burdock, a member of the same great family of plants. The Canada thistle has a root system peculiar to itself and renders the plant particularly difficult to eradicate, the depth to which the long roots descend in the rich loose soil being many feet. It only remains to say that the St. John's wort is not an easy pasture weed to pull on account of its deep anchorage, and the dock is likewise noted for its size and length of root.

The list of big-rooted biennials consists of: *Medicago lupulina*, L. (nonesuch), *Œnothera biennis*, L. (evening primrose), *Daucus Carota*, L. (wild carrot), *Pastinaca sativa*, L. (parsnip), *Dipsacus sylvestris*, Mill. (teasel), *Cynoglossum officinale*, L. (hound's tongue), *Echium vulgare*, L. (blue-weed), *Verbascum Blattaria*, L. (moth mullein) and *Verbascum Thapsus*, *L.* (mullein). For the size of its ærial portion the blue-weed or viper's bugloss is perhaps the largest rooted biennial, but this is closely followed by the carrot and parsnip among the lower weeds, and by the evening primrose, teasel and the mulleins for the larger species of the group. From the biennial nature of these plants it follows that if they are kept from seeding the land will soon be rid of them.

The weeds having tap-roots ranking in the second size, number twenty-two as follows: perennials, five; biennials, one, and annuals, sixteen, thus showing a large number in the last group. The perennials are: *Malva rotundifolia*, L. (mallow), a low plant with a stout, woody tap-root; *Passiflora incarnata* (passion vine), a deeply rooting noxious weed of the Southern States, *Cichorium Intybus*, L. (chicory), a tall and deeply-anchored plant. *Brunella vulgaris*, L. (heal-all) and *Nepeta Cataria*, L. (catnip) are the other two perennials of this class, both belonging to the mint family. The catnip being the larger weed, as might be expected it has the greater root. There is only one biennial in group 2, namely, *Barbarea vulgaris*, R. Br. (yellow rocket), which has a strong root like the chicory and mallow.

The annuals, while not above the average in size, make a considerable list as follows: *Brassica nigra*, L. (black mustard), *Capsella Bursa-pastoris*, (L.) Mœnch. (shepherd's purse), *Lepidium campestre* (L.), R. Br. (field pepper-grass), *Lepidium Virginicum*, L. (pepper-grass), and *Sisymbrium officinale* (L.), Scop. (hedge mustard)—all of the same family, the Cruciferæ, and very much alike in root habit. *Lychnis Githago* (L.), Lam. (corn cockle), is a tall, slender weed of the grain fields, and *Abutilon Avicennæ*, Gært. (velvet leaf), a rank pest of cultivated ground. Among the Compositæ there are *Anthemis Cotula*, L. (mayweed), and *Xanthium Canadense* (Murr.), Gray, (cocklebur), plants quite different in their size and capacity for mischief. *Datura Tatula*, L. (thorn apple), and *Solanum Carolinense*, L. (horse nettle), are two members of the nightshade family, the former a tall, much-branched, rapidly-growing weed, and the latter a low spinose pest. There are three of the pigweeds, namely, *Amarantus albus*, L. (tumble-weed), *A. chlorostachys*, Willd. and *A. retroflexus* (common pigweeds), all of which have similar sizable roots, as has likewise their cousin, *Chenopodium album*, L. (goose-foot). The last of the list is *Polygonum Convolvulus*, L. (bind-weed), a miserable vine that is strongly and deeply rooted.

There are six species in the group of weeds with moderately large root systems belonging to the fascicled type. Four of these are perennials, as follows: *Asclepias Syriaca*, L. (milkweed). When grown in its best estate in the rich prairie soil, this should perhaps be ranked in the first group. The plant as a whole is large, and grows in thick patches; the big roots make it difficult for the plow to be drawn among them. *Linaria vulgaris*, Mill. (toad-flax), fills the soil with a mat of fibrous roots, some of which are of considerable size. *Polygonum dumetorum* var. *scandens*, (L.), Gray (climbing buckwheat), has also a similiar root system. The quack grass (*Agropyrum repens*, (L.)

Beauv.,) is notorious for its roots so-called, which are, strictly speaking, a mass of tough underground stems from the joints of which small fibrous roots proceed ; taken as a whole, however, the root system is large and merits the place assigned.

Of the biennials there are only two in this group of the second class, namely, *Melilotus alba*, L. (white melilot) and *Erigeron strigosus*, Muhl. (fleabane), both of which are abundantly provided with a mass of small roots.

Passing now to the mixed system it is found that there are seven distributed among the perennials and annuals ; of the former there are *Leonurus Cardiaca*, L. (motherwort), the two plantains, namely, *Plantago lanceolata*, L., and *Plantago Rugelii*, DC. and the *Rumex Acetosella*, L. or sorrel. While the first three have roots quite alike, that is with a more or less strong, downward, central root and several others springing directly from it near the crown, the sorrel develops its roots horizontally and near the surface of the ground. The three annuals in group two with mixed roots are—*Solanum rostratum*, Dun. (Texas horse nettle), *Amarantus blitoides*, Wats. (spreading figweed)—both low prostrate plants—and *Chenopodium ambrosioides*, L. (goosefoot).

Of the weeds with medium sized tap-roots there are three species, namely: *Helenium tenuifolium*, Nutt., *Nepeta Glechoma*, Benth. and *Acalypha Virginica*, L. The first is one of the worst weeds in the Southern States according to Prof. Tracy, who contributes the specimens to the century. In the second or ground ivy, we have a plant that forms dense masses of low growth in neglected places; while the third, the three-seeded mercury, is a widespread and common weed in moist land, particularly meadows. In the biennials of this group there is but a single species, namely: the *Echinospermum Lappula*, Lehm. (stickseed), which, while a medium sized weed, is exceedingly annoying to live stock, particularly sheep, on account of its bur-like seeds.

The annuals with average sized roots are more numerous than in the other two groups and include the following: *Brassica Sinapistrum*, Boiss. (charlock), *Raphanus Raphanistrum*, L. (wild radish), *Hibiscus Trionum*, L. (bladder ketmia), *Mollugo verticillata*, L. (carpet weed), *Diodia teres*, Walt. (button weed), *Sonchus oleraceus*, L. (sow thistle), *Polygonum aviculare*, L. (knotgrass), *Euphorbia Preslii,* Guss., (spurge) and *Euphorbia maculata,* L. (spotted spurge). It will be seen that this is a variable set, varying in size from the charlock and its cousin the wild radish down to the prostrate carpet weed and spotted spurge. All form seed in great abundance, the ketmia in large capsules, the sow thistle in heads and provided with airy balloons, but most of the species have inconspicuous seed vessels.

In the group of perennials with medium sized fascicled roots, there are four species to mention, namely: *Ranunculus acris,* L. (tall buttercup), *Hieracium aurantiacum,* L. (orange hawkweed), *Rudbeckia hirta,* L. (cone-flower) and *Cyperus rotundus,* L. (coco-grass). The buttercup is an old weed of the grass land, while the hawkweed is a comparatively new comer and is spreading rapidly. In the cone-flower we have a prairie weed that has spread eastward rapidly and vies with the common daisy for the occupation of the meadows. In the coco or nut-grass there is a very difficult pest to eradicate on account of its "nuts" below ground, which serve to spread the weed. There is but a single biennial to be mentioned here, but it is a very common one—the *Erigeron Canadensis,* L. (fleabane or horseweed). The annuals again are the largest in number, there being six as follows: *Anthemis arvensis,* L. (chamomile), *Erechthites hieracifolia,* (L.) Raf. (fireweed), *Polygonum Pennsylvanicum,* L. (smartweed), *Bromus secalinus,* L. (cheat or chess), *Panicum Crus-galli,* L., (barnyard grass), *Panicum sanguinale,* L. (crab or finger grass). The chess has the greatest variety as a weed; the fireweed is the rankest grower in places suited for it and the two *Panicums* are almost everywhere.

In the group with the root somewhat below the average in size, there are for the tap-rooted sorts only one for the biennials, namely: *Lamium amplexicaule,* L. (dead-nettle), and two for the annuals, as follows: *Stellaria media,* (L.), Smith (chickweed), *Portulaca oleracea,* L. (purslane). These are all small plants, the dead-nettle or henbit reaching highest from the ground, while the purslane is a succulent prostrate weed.

In the fascicled group for the size called number four there are two species, namely: *Ranunculus bulbosus,* L. (buttercup) and *Chrysanthemum Leucanthemum,* L. (ox-eye daisy).

It is somewhat of a surprise to find the root system of the common daisy comparatively small. It is only when the plant is old and has developed many flower stalks in a cluster that the roots become of a size to interfere at all with cultivation. Among the annuals there are four species with similar root systems, all of which are among the grasses, namely: *Bromus tectorum*, L. (chess), *Panicum capillare*, L. (witch grass), and the fox-tails, *Setaria glauca* (L.) Beauv. and *Setaria viridis* (L.), Beauv. Ordinary plants of any of these four grasses when grown separately make but a small cluster of fibrous roots.

Of those with a combination of the tap and clustered form of rooting in group four there are only two and these are both annuals and closely related, namely, *Ambrosia artemisiæfolia*, L. (ragweed) and *Ambrosia trifida*, L. (horseweed). These from their large size have root systems that are more extensive than those of many other weeds mentioned in previous groups, but in this classification it has been relative rather than absolute size that has governed in the classification. The ragweeds have a comparatively small root system.

In the last group, namely, those with the smallest root system, there are but few examples. Among the biennials there is but one and it, *Allium vineale*, L. (wild onion) is a vile pest in many dairy regions. Aside from the bulb there seems to be little else below the ground. There are four of the annuals that are here grouped, namely: *Veronica peregrina*, L. (speedwell), *Orobanche ramosa*, L. (broom rape), *Cenchrus tribuloides*, L. (sand-bur) and *Eleusine Indica* (L.) Gærtn. (wire grass). The speedwell is a short-lived weed of early summer; in the broom rape we have a parasitical pest of the hemp and some other field crops, while the last two species are grasses, one a native and particularly obnoxious on account of its spinose fruit, while the last on the list is a foreigner that is growing in numbers but not in favor among us.

[Since writing the above one change has been made in the century, namely: the substitution of *Physalis Virginiana*, Mill., for *Polygonum dumetorum*, var. *scandens*, which does not affect the classification materially.]

Rutgers College, Dec. 28th, 1891.